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Role of Artificial Intelligence in the Software Development Life Cycle

Manisha Wadhekar

JSPM University, Pune, Maharashtra, India
manishawandhekar46[at]gmail.com

Abstract: ***The integration of Artificial Intelligence (AI) in the Software development life cycle has greatly improve the software development in this research paper studies on how Artificial Intelligence improves in every phase of software development life cycle including understanding 1. Requirement gathering, 2. Analysis, 3. Planning, 4. Development, 5. Testing, 6. Deployment, 7. Maintenance. the study reviews multiple research paper and industry practices to understand technologies like machine learning (ML), large language models (LLMS), and automation tools are changing and improving each stage of software development. AI-powered tools make work faster and more accurate, reduce mistakes, and help bring products to market but there is also have new challenges like getting people to trust them, understanding how they work and learn new skills. research show that companies that use AI tools in their software development process are changing the way they build software these methods improve code quality and make the software development process faster and more efficient. that is the reason AI is becoming an increasingly important part of modern software engineering practices.***

Keywords: Artificial Intelligence, Software Development Life Cycle, Machine Learning, Code Generation, Automated Testing, DevOps

1. Introduction

The software development life cycle (SDLC) since many years ago was mostly done by humans and it required a lot of paper/manual work in different phase. But now new Artificial Intelligence (AI) technologies such as large language models (LLMS) and machine learning are changing the way software is developed AI is present at every phase of software development life cycle from what require for planning, development, testing, and maintenance phases. This is major shift, called 'AI-native development' meaning AI is not just a tool but a they are completely helps in software development process. In this you can especially see the change in the way development teams solve. in traditional way of working which needed a lot of manual coding, fixing error and writing document are now helped by smart system that can write code find bugs before running it and even give ideas to improve the design this paper show how AI helps in every stage of software development SDLC phases, it looks at how this phase works studies the benefits and complications of combining these technologies and explains what it could mean for the future of software engineering. A researcher and other members have studied Software development life cycle models to find and understand their strengths, weaknesses, and suitability for different type of project. In a software development the traditional models like waterfall model, spiral model, and V-model that follow a process in multiple steps one by one and fixed them but they are getting so time to complete the software but the AI based modern approaches like Agil and DevOps they are focus on teamwork, flexibility and delivering project updates continuously our customer.

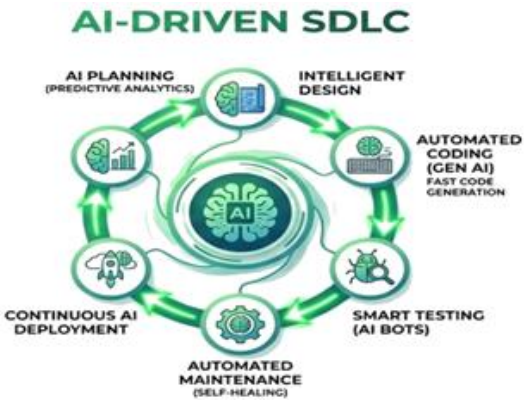
2. Literature Review

1) Abbas et al. (2025) Enhancing software Engineering with AI: Innovation, challenges and future directions- AI's impact on software engineering, highlighting automation, predictive modelling, and defect detection. AI tools leverage machine learning and NLP to automate complex tasks and improve quality. Challenges include lacks of transparency, ethical issues, and integration AI with DevOps. AI can be improved software development but it must be used with proper rules and ethical guidelines.
2) Harsha Reddy (2025)- AI-Driven Secure Software Development Lifecycle -this research focuses on integration with AI in Software development lifecycle they can be improve software security in the SDLC. AI can help in automatically detect security problems like SQL injection; it also helps development write safer code and perform automatic security testing. AI can available for any time like 24/7 security guard that find errors and bugs before launch and stope hacks in real time. It makes software safer.
3) Saha (2025)- Improving Software Development using AI- enabled predictive analytics – in the saha's research shows that AI is predict risks, defects, and delay in software development using past project data they can improve decision making during projects planning, according to the research AI can identify the data or patterns and they predict the future outcomes and that is the reason the AI can helps in team estimate project timelines and allocate resources more effectively. They can help team focus on high risks parts and they improving software quality and saving time. It also helps with project plans with understanding requirements and making decision
4) Sauvola et al. (2024) – Future of Software Development with Generative AI-sauvola and his team founds that the generative tools like GPT help developer write code, test software automatically, create documents it's save times and increases productivity, the AI can be suggest the code for developing they helping dev code faster by spotting reusable patterns, they can automate boring tasks like debugging, but raises questions about code ownership and job roles it can be increase productivity but it will change how software development works.
5) Chintagunta (2025) – Role of Artificial intelligence in Software Development-in this research paper the chintagunta's paper shows that AI framework like

tensor and PyTorch that help in create smart software and in this paper talks about how the tools used in the software engineering, this paper highlights the use of ML, NLP and deep learning in various SDLC phases. Artificial intelligence can be help in develop software by writing code, finding bugs and testing automatically. The specialized tools like GPT make coding faster and more efficient they also highlight new trends like self-fixing software and artificial intelligence that can explain its own logic, AI can help in software system fix themselves and it's important to integration AI with existing practices they enhance decision making and productivity in early stages

6) Sharma and gupta (2023) – Machine Learning for Software Defect Prediction-this research paper can focus on the application of machine learning technique in predicting software defect during development, thost and improving software softe ML models like decision tree and network can spot buggy code by analyzing past bug reports, the ML models help developers find part of software early they reduce testing cost and improving software quality. but they need good quality data to give accurate result
7) Kim et al. (2022) – Deep Learning for Automated Software Testing – Kim and his teammates they studied how to use deep learning in artificial intelligence to find bugs in computer programs automatically. their research shows that neural network model can automatically create test examples and find mistakes in complicated software, needing that much involving humans. Kim's shows AI testing tools can understand how a program run, analyze code path and create better test cases automatically. this-tools saving lot of manual testing time, AI – based testing can make faster and make software more
8) Brown and Wilson (2023) -AI- Based Requirement Engineering -this research paper shows look at how AI is used in requirement engineering the writer suggest system that use AI and (NLP) natural language processing to automatically understand what user and stakeholder write and then it helps identify what the software needs to do. The system or AI can find mistakes, errors confusion in customer's requirements and makes better, so developers and customer can understand each other clearly
9) Garcia et al. (2021) – AI-Driven DevOps Automation-In this research paper the Garcia and their team mates studied how AI technologies can be enhance with DevOps practices. This research paper highlights that AI can automatically handle tasks like combining software, deployment and checking how it is working, AI uses machine learning to analyze system logs and find unusual problems, which helps detect system failures early this research proves artificial intelligence driven DevOps makes a software faster and more reliable.
10) Zhang et al. (2022) – Intelligent bug detection system – In this research paper the researcher focuses on AI based bug detection system for software testing, the researchers created a deep learning models that checks codes and finding bug or programming errors automatically this paper shows that artificial intelligence can find bugs earlier than traditional debugging method they find problem early, and save money and makes software easier to manage and update
11) Ahmed et al. (2023) – AI in Software Project Management – In this research paper the researchers explores how artificial intelligence can support software project management system with different tools, In AI-based project management tools they analyze the data from past projects, they use this information to understand patterns and trends in market based on these patterns and the tools can predict if a many thinks like current project takes too much time and might get delayed and estimate how many peoples, time or resources will be required the tools are help project manager plan their work more effectively and avoid possible problems
12) 12.Lee and park (2022) – Intelligence Software Maintenance System – In this research paper the writer focuses on AI-Driven maintenance system that automatically monitor software performance ML machine learning models study how the system is working while it is running and look for unusual patterns, AI checks the system is find problem in real time it early even before the system fails. The writer says the predictive system can reduce system maintenance cost and downtime; AI can predict errors at early phase.

3. Methodology



1. Artificial Intelligence Tools Across SDLC phases

1.1 Requirement gathering and planning phase

During the early stages of SDLC, artificial intelligence helps a lot in understanding project or software basic requirements and also in planning the project. Natural Language processing (NLP) models can be understanding stakeholder or customers conversation to what exact requirement for projects specifications. AI analysis the data from past projects to predict how long time takes and what resources a new project will take for development. this system can analysis the data from past projects and find common problems and suggesting the way to avoid them using the knowledge collected by the organization.AI also helps with creating documents and turning information conversation into structured specification that form the basis for further work.

1.2 Development and Implementation phase

In the development phase the Artificial Intelligence has brought the biggest changes in the development code generation tools based on Large Language Models (LLMs), like a GitHub Copilot and Amazone Code Whispers, can be create working code from simple description or incomplete code with in less time. These tools work as a intelligence assistance, they suggesting code completion, suggesting optimization and even they creating entire functions based on context. Research show that developers who use AI coding tools like GitHub can complete regular programming tasks 40% then faster. AI not only helps in writing code but also help in choose better design patterns and find possible security problems while coding. Static analysis with the help of Machine Learning that detect error from code and bad patterns in code better than traditional method allowing developers to fix quality issues earlier.

1.3 Testing and Quality Assurance Phase

Artificial Intelligence greatly improved software testing through test generating, execution and analysis machine learning (ML) can automatically generate test cases, create, run and check tests based on code AI can generate many test cases and test more part of program than manual testing. AI testing tools identify path through part of an app and focuses on testing based on risks and usage patterns. In continuous combination environment, AI stem analysis test results to find unreliable tests they predict possibility in complications in future also failures, and suggest ways to fix them. Self-healing test automation is an important improvement. AI automatically adjusts test scripts to minor changes in the app, reducing test automation maintenance visual testing tools use computer vision to find problem in the app's interface that normal testing might miss.

1.4 Deployment, Maintenance, and Operation

In the deployment and operations phases Artificial intelligence helps Dev Ops work smarter.it can predict system performance and needed resources, allowing team to prepare and scale in advance.AI keeps a 24/7 eyes on system to tell the different between normal glitches and real threats when something actually breaks the AI quickly dig through the data to find the exact cause helping teams fix the problem much faster than they could on their own. Chatbots and smart assistants handle common issues suggesting docs or past cases this make a maintenance predictive and preventive, improving system reliability and cutting cost.

4. Challenges and Consideration

Even though many benefits using AI in SDLC also has same challenges such as high cost, lack of skilled professionals, data security risk, integration difficulties and something inaccurate results that organization need to manage. When AI system make decision or generate code without explaining why people loss trust and perceive a lack of transparency. Many AI models are like black boxes it's making hard to understand the decision which is tough for rules. You can't trust blindly on AI- generated can be create a code but with hidden bugs, licensing problem and security risks so human needs to check it carefully, developers have to learn new they also have to keep the basic skills, privacy and security can be a problem because AI tool needs access to a company's data and also code

5. Result

The result of this research paper show that how (AI) Artificial Intelligence has a positive impact on the (SDLC) software development life cycle. AI can improve the accuracy, speed, and efficiency of software development. In the requirement phase AI can help in what we need for the software they understand users need clearly. they reduce confusion and improve communication with user. In planning phase AI can predict the cost, risk, time and resources and they help in better planning. In the development phase AI tools help to develop or write code faster. They improve the quality and speed of writing code in less time; the tools can be suggested and detect the error in early. In testing phase AI can be automatically test and detect the bugs faster and focus on high-risk areas AI can improve testing efficiency and software reliability. In deployment phase Ai can monitor the system performance and detect the issue early and prevents failures. In the maintenance phase AI can support the predictive maintenance they identify the future problems and reduces downtime. AI also help in improves DevOps by enabling automation and monitoring, overall, artificial intelligence can improve productivity, reduce error and enhance software quality.

6. Conclusion

Artificial Intelligence has become a very powerful force in transforming the software development life cycle (SDLC). It completely changed the way software planed, designed, developed, tested, and maintained and they also help in improving codding quality, speed, system reliability, and overall performance, from the requirement to maintenance they improve accuracy and reduce human effort. AI can be takes automatically smart decision they allow development team to focus on more complex and creative aspect of software engineering. The organizations that use artificial intelligence in software development gain a competitive advantages AI can deliver faster, reliable and high-quality software solutions. AI also bring changes such as data quality issue, lack of transparency and trust concerns. AI can't replace the developer but proper supporting them in their work it's act like a smart assistant that improve productivity and decision-making capability. Many companies that adopt AI-Driven or AI-native development approaches they gain a strong in today's fast-evolving, technology- driven environment. In the future software development will depend on strong collaboration between human and AI. Artificial intelligence is playing a important role in making software development life cycle smarter, faster, and more efficient.

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